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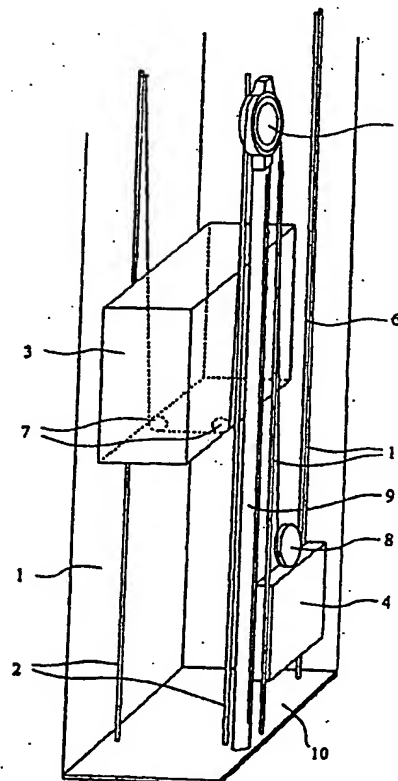
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(54) Title: ELEVATOR ARRANGEMENT

(57) Abstract

Elevator arrangement comprising an elevator shaft (1), at least one guide rail (2) extending vertically in the elevator shaft, a car (3) guided by the guide rail and moving in the shaft, a counterweight (4) and an elevator machine (5) with an elevator rope (6) and diverting pulleys (7, 8) for moving the car and counterweight, the elevator machine comprises an auxiliary support (9) separate from the guide rail (2) and placed between the elevator shaft and the elevator machine, the weight of the elevator machine (5) being partially applied to the auxiliary support.



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ELEVATOR ARRANGEMENT

The present invention relates to an elevator arrangement as defined in the preamble of claim 1.

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A common solution in elevators without machine room is to mount the elevator machine on guide rails attached to the walls of the elevator shaft. Via the guide rails, the load imposed by the weight is transmitted to the bottom of the shaft. Thus, the weight of almost all of the elevator structures rests on guide rails attached to the wall. As both the machine, the car, the counterweight, all diverting pulleys and the ends of the elevator ropes are supported directly or indirectly on the guide rails, this places strict requirements on the guide rails and the manner in which they are fixed to the wall.

Because of the heavy load applied to a single guide rail, the guide rails need to be of a robust design, which in itself may increase the manufacturing costs. In addition or alternatively, the guide rails must be attached to the wall of the elevator shaft with fixtures placed at relatively short distances from each other, which is often difficult because there are only a limited number of points where the guide rails can reasonably be attached. In many cases, it is only at the floors that the guide rails can be sufficiently firmly fixed to the building. Increasing the number of points of guide rail attachment means an extra increase in both material costs and installation expenses.

Since in prior-art solutions large and variable loads, or at least their horizontal components, are applied to the wall structures of the elevator shaft, a possible problem is the noise or vibration transmitted from the

guide rail to the wall. Accordingly, elimination of this problem must be taken into account in the design of the elevator shaft, which may give rise to additional expenses and problems in the construction of the elevator shaft.

The same problems described above also appear in elevator applications in which the machine, some of the diverting pulleys, the rope ends and/or other parts of the elevator are fixed to the top of the elevator shaft.

Specification EP 849209 also presents a prior-art application which uses a separate pole of a height extending through the whole shaft, the machine being mounted on the upper end of the pole so that the entire weight of the machine is transmitted via the pole to the bottom of the shaft. However, this application requires complex pole structures and supports and it is therefore not a realistic alternative to other known structures.

The object of the invention is to eliminate the above-mentioned drawbacks. A specific object of the invention is to disclose a new type of elevator arrangement which, being relatively independent of the elevator shaft, allows correct application of the effect of the forces acting in the elevator shaft as well as optimal design of the structures used in respect of both size, weight and costs. A further object of the invention is to achieve simpler and faster installation of the various components of the elevator in the elevator shaft.

As for the features characteristic of the invention, reference is made to the claims.

The elevator arrangement of the invention comprises an elevator shaft with at least one guide rail extending vertically in the elevator shaft, said guide rail serving to guide an elevator car moving in the shaft. Usually there are two guide rails for the elevator car, but the invention does not limit the number of guide rails to any given number. Moreover, the elevator arrangement comprises a counterweight with possible guide rails as well as an elevator machine with elevator ropes and diverting pulleys for moving the elevator car and counterweight in the elevator shaft. The elevator machine is mounted on the guide rail and the machine preferably consists of a discoid flat permanent magnet synchronous motor which can be mounted in the space between the elevator car and the wall of the elevator shaft.

According to the invention, the elevator arrangement comprises an auxiliary support between the elevator shaft and the elevator machine, preferably a mainly vertical structure extending in the longitudinal direction of the shaft and bearing part of the weight of the elevator machine. The auxiliary support may be an element separate from the guide rail or it may be a supporting element attached to the guide rail, designed to receive a vertical load. Thus, the stresses imposed by the elevator machine and the car and counterweight loads at least partially applied to it, instead of being applied to the guide rails or ceiling structures of the elevator shaft as in traditional solutions, are passed to an auxiliary support separate from the guide rails and the ceiling and walls of the elevator shaft so that, although the elevator machine is mounted at a place found to be good for it, i.e. on a guide rail, the loads imposed by it are not exclusively applied to

the guide rail but a substantial proportion of them is applied via the auxiliary support to other parts.

One end of the auxiliary support preferably rests in the lower part of the elevator shaft, e.g. on the bottom of the elevator shaft, but other points of support are also possible. Thus, the auxiliary support may also pass the load of the machine to other points along the vertical dimension of the shaft.

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The elevator shaft may be provided with several auxiliary supports according to the invention, with e.g. one support on either side of the elevator car and one on either side of the counterweight. The number of auxiliary supports may vary from case to case, in such manner that a sufficient proportion of the vertical loads otherwise applied to the guide rails can be passed via the auxiliary supports past the guide rails to the structures of the elevator shaft, preferably to its bottom.

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In a preferred embodiment, all vertical forces applied to the auxiliary supports by the auxiliary supports themselves and the loads supported by them are applied to the bottom of the elevator shaft. In this case, the auxiliary supports are braced using lateral supports attached to the walls of the elevator shaft at vertical distances from each other, said lateral supports only keeping the auxiliary support upright without supporting it vertically in any way. Such lateral supports may consist of e.g. sleeve-like or collar-like fixtures placed around the auxiliary support to hold it, yet without preventing movement of the auxiliary support through the collar or sleeve. Such collars or sleeves can then be attached to the wall of the elevator shaft

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so that only insignificant horizontal supporting forces are applied to the wall.

Depending on the number and placement of the auxiliary supports in the elevator shaft, they can be used to support various structures and parts of the elevator. Thus, one end or both ends of the elevator rope can be attached directly or indirectly to an auxiliary support. Likewise, one or more of the car or counterweight guide rails may be completely or partially supported by an auxiliary support. It is also possible to connect or join the auxiliary supports e.g. at the upper end of the elevator shaft to each other using a suitable bracing structure, rigid beams or equivalent. Thus, e.g. the elevator machine mounted on a guide rail or the ends of the ropes can be attached to this bracing structure, through which a significant proportion of the loads is passed to the auxiliary supports and further e.g. to the bottom of the elevator shaft.

In the simplest case, the elevator arrangement of the invention comprises only one auxiliary support. In this case, the largest and most significant vertical loads of the elevator structure can be passed to the auxiliary support. Thus, in addition to the elevator machine mounted on a guide rail, the guide rail itself can be at least partially supported by the auxiliary support. Similarly, by using suitable supporting arrangements, both ends of the elevator rope can be connected to the same auxiliary support to reduce the loads applied to the guide rails and certain parts of the elevator shaft and to apply the loads to more appropriate points.

The auxiliary supports used may consist of various steel and/or concrete structures. A preferred structural solution for the auxiliary support is a straight

steel tube filled with concrete. Of course, other auxiliary support structures that are sufficiently rigid and have a sufficient load-bearing capacity may be used as well.

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- As compared with prior-art technology, the elevator arrangement of the invention has significant advantages:
- considerably lighter car guide rails can be used because the elevator machine mounted on them produces no
 - 10 stress on the guide rail, thus significantly reducing manufacturing and installation costs;
 - as the guide rails and the auxiliary support/auxiliary supports can be designed together, overdesign of both guide rails and auxiliary supports
 - 15 is avoided without impairing the load-bearing capacity of the structure,
 - structural design of both the elevator and the elevator shaft becomes easier because the loads produced by the machine and other elevator components can be ap-
 - 20 plied relatively freely via auxiliary supports to suitable points in the elevator shaft,
 - an elevator can be installed in a space which does not provide sufficient possibilities for mounting the elevator components in the traditional manner,
 - 25 - since constructing an elevator is made less dependent on the environment in which it will be used, i.e. the elevator shaft, the elevator manufacturer will be able to produce in a controlled factory environment easy-fit elevator packages, larger assemblies to be installed at
 - 30 once, thus allowing faster installation of the elevator in the elevator shaft and reducing the error potential.

In the following, the invention will be described in detail by referring to the attached drawing, which pre-

35 sents a diagram representing an elevator arrangement according to the invention.

The elevator arrangement presented in the drawing comprises an elevator shaft 1 with a bottom 10 and walls. Placed in the elevator shaft are two guide rails 2 designed to guide an elevator car 3 moving along them. Mounted on one of the guide rails 2 is an elevator machine 5, which consists of a permanent magnet synchronous motor. In addition, the shaft is provided with another pair of guide rails 11, designed to guide a counterweight 4 moving along them. Although the elevator machine 5 is attached to the guide rail 2, its weight is not applied exclusively to the guide rail but the machine is supported by a separate auxiliary support 9 on the bottom 10 of the elevator shaft. The auxiliary support 9 consists of a vertical pole extending directly down from the elevator machine to the bottom of the elevator shaft. Therefore, the guide rail or its fixtures need not be designed to withstand all the loads produced by the elevator car 3, the counterweight 4 or the elevator machine 5, because part of the stress caused by these loads is transmitted via the auxiliary support 9 directly to the bottom 10 of the elevator shaft.

The auxiliary support 9 is preferably fastened to the wall of the elevator shaft via sleeve-like or collar-like lateral supports so that only slight horizontal supporting forces are applied to the wall of the elevator shaft.

In the elevator arrangement presented in the drawing, one end of the elevator rope 6 is fixed to the upper end of one 2 of the guide rails for the car 3. From there, the elevator rope runs to diverting pulleys 7 at the bottom of the elevator car and upward again to the traction sheave of the elevator machine 5 mounted on

the other guide rail 2. From here, the elevator rope runs downward via a diverting pulley 8 on the counterweight 4 and further up toward the upper end of one of the guide rails 11 for the counterweight 4, where the rope end is fixed. A significant proportion of the loads acting in the elevator arrangement, imposed by the car 3, the counterweight 4 and the elevator machine 5, is applied via the auxiliary support 9 to the bottom 10 of the elevator shaft. The stress caused by these loads is therefore not applied to the guide rails and via these to the walls of the elevator shaft.

The elevator arrangement presented in the diagram may also be provided with several auxiliary supports, which can be used to support the points of anchorage of the rope 6 on the guide rails 2 and 11. Similarly, the auxiliary support 9 supporting the elevator machine may be provided with additional structures to transmit the stresses applied to the guide rails by the rope 6 to the auxiliary support and via it to the bottom 10 of the shaft.

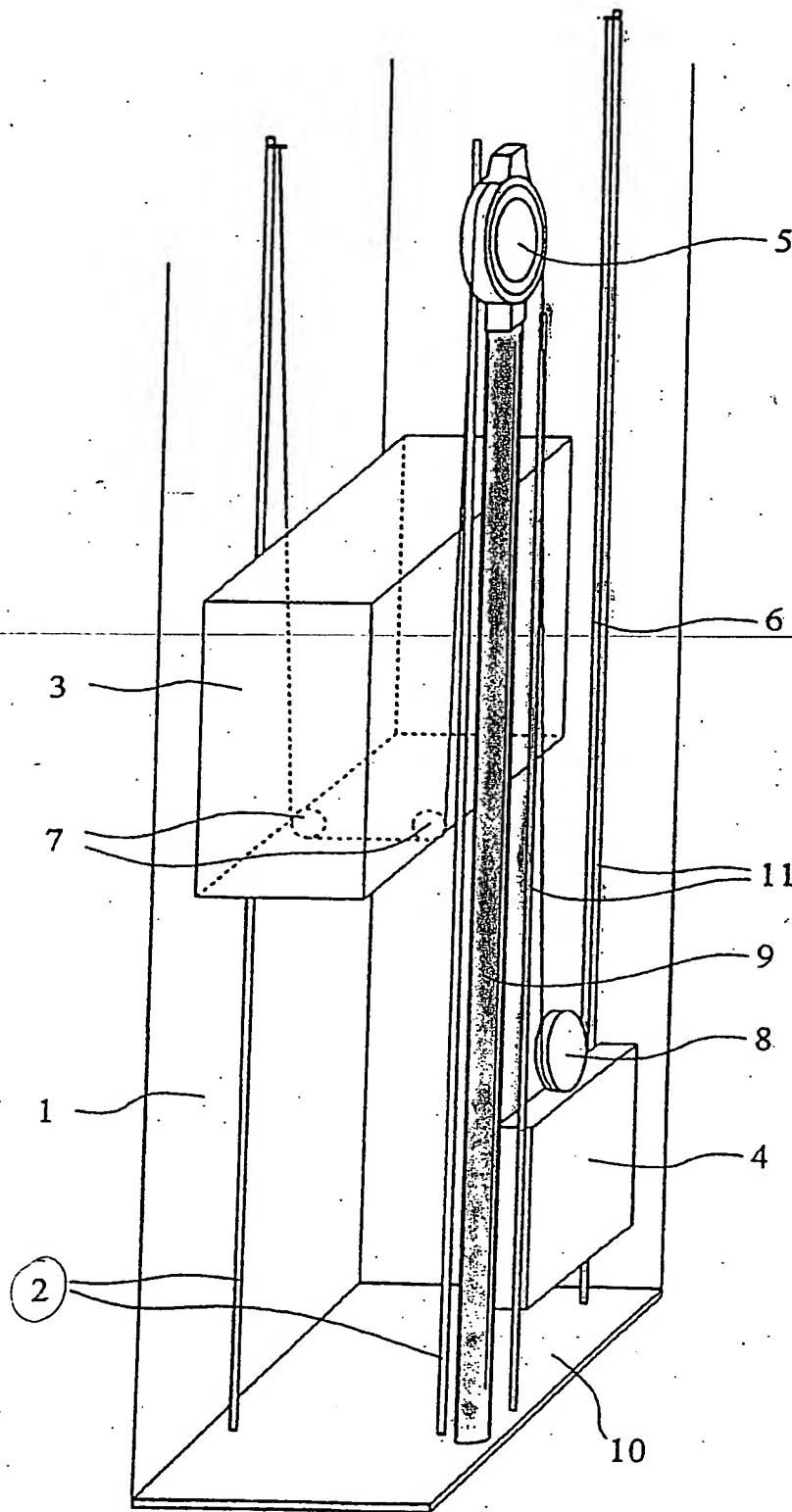
In the foregoing, the invention has been described by way of example with reference to the attached drawing while different embodiments of the invention are possible within the scope of the inventive idea defined in the claims.

CLAIMS

1. Elevator arrangement comprising
- an elevator shaft (1),
 - 5 - at least one guide rail (2) extending vertically in the elevator shaft,
 - a car (3) guided by the guide rail and moving in the shaft,
 - a counterweight (4) and
 - 10 - an elevator machine (5) with an elevator rope (6) and diverting pulleys (7, 8) for moving the car and counterweight, said elevator machine being mounted on the guide rail, characterised in that the elevator arrangement comprises an ~~auxiliary support~~ (9) separate
 - 15 from the guide rail (2) and placed between the elevator shaft and the elevator machine, the weight of the elevator machine (5) being partially applied to said auxiliary support.
- 20 2. Elevator arrangement as defined in claim 1, characterised in that the auxiliary support (9) rests on the bottom (10) of the elevator shaft (1).
- 25 3. Elevator arrangement as defined in claim 1 or 2, characterised in that the elevator arrangement comprises at least two auxiliary supports (9).
- 30 4. Elevator arrangement as defined in any one of claims 1 - 3, characterised in that the auxiliary support comprises lateral supports placed at a distance from each other in the vertical direction, which lateral supports do not carry the weight and vertical load of the auxiliary support.

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5. Elevator arrangement as defined in claim 4, characterised in that the lateral supports are attached to the wall of the elevator shaft (1).
- 5 6. Elevator arrangement as defined in any one of claims 1 - 5, characterised in that the auxiliary support has been arranged to carry the end of the elevator rope (6) or an anchorage for the rope end.
- 10 7. Elevator arrangement as defined in any one of claims 1 - 6, characterised in that the auxiliary support is supported on a guide rail (2) for the car (3).
8. Elevator arrangement as defined in any one of claims 1 - 7, characterised in that the auxiliary support is supported on a guide rail (11) for the counterweight (4).
- 15 9. Elevator arrangement as defined in any one of claims 1 - 8, characterised in that the auxiliary support consists of a stanchion made of steel, concrete or a combination of these.
- 20 10. Elevator arrangement as defined in any one of claims 1 - 9, characterised in that the auxiliary support consists of a steel tube filled with concrete.
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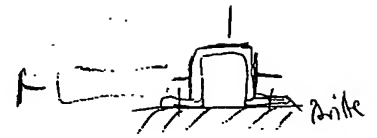


Figure 1

INTERNATIONAL SEARCH REPORT

Inter. Appl. No.
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B66B11/00 B66B7/02 B66B7/08

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Minimum documentation searched (classification system followed by classification symbols)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 849 209 A (OTIS ELEVATOR CO) 24 June 1998 (1998-06-24) cited in the application the whole document	1-8
X	EP 0 841 283 A (INVENTIO AG) 13 May 1998 (1998-05-13) the whole document	1
A	EP 0 710 618 A (KONE OY) 8 May 1996 (1996-05-08) page 2, column 2, line 36 -page 2, column 4, line 7; figure 1	1
A	EP 0 688 735 A (KONE OY) 27 December 1995 (1995-12-27) page 4, column 5, line 42 -column 6, line 11; figures 4,5	1

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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